

Nov. 4, 1969

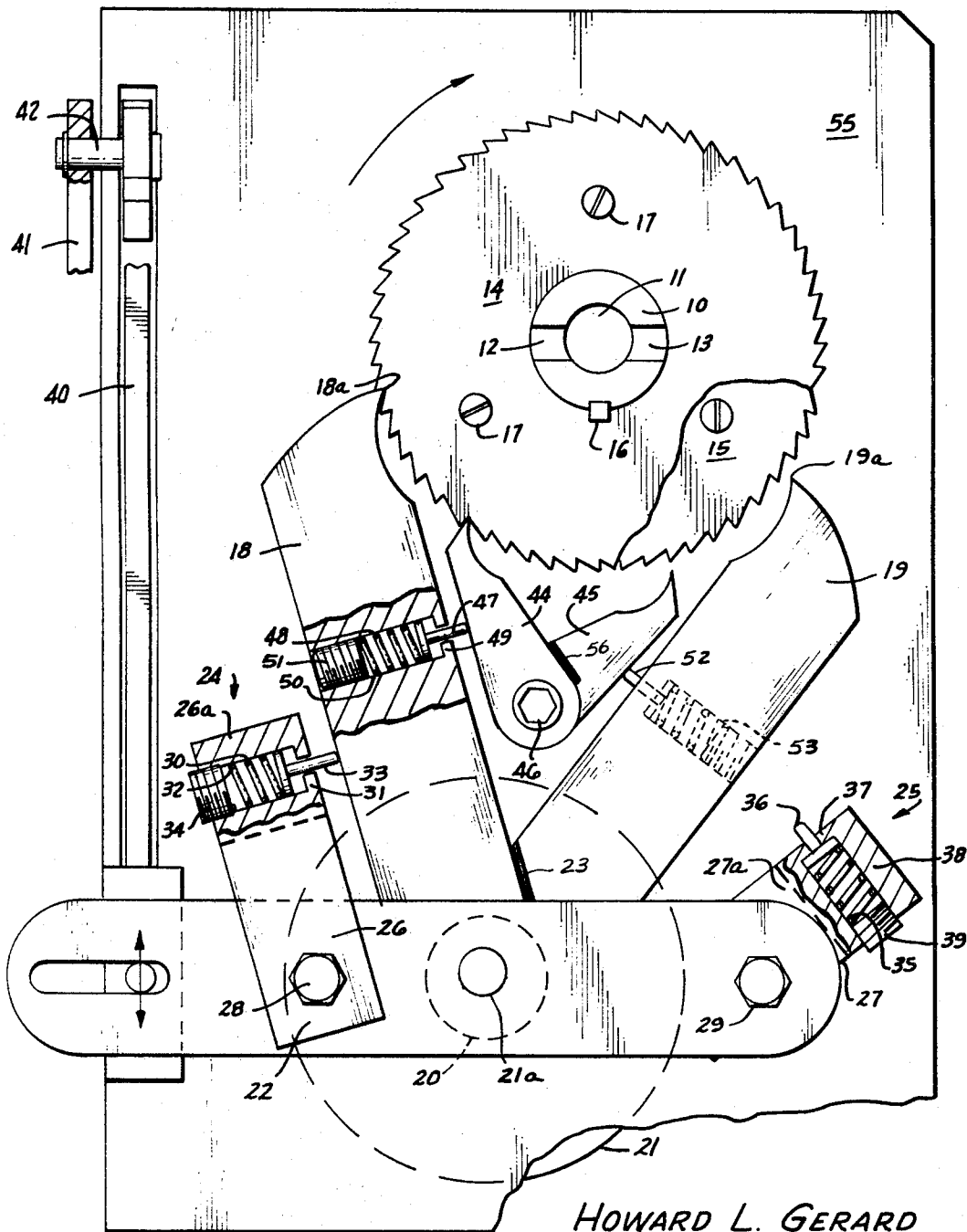
H. L. GERARD

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MOTOR OPERATOR FOR LOAD BREAK SWITCH

Filed Nov. 20, 1967

2 Sheets-Sheet 1



HOWARD L. GERARD
INVENTOR.

BY
Browning, Simms, Hyer & Eickhardt

ATTORNEYS

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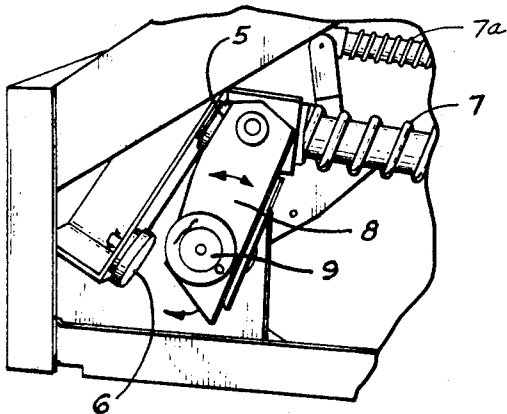
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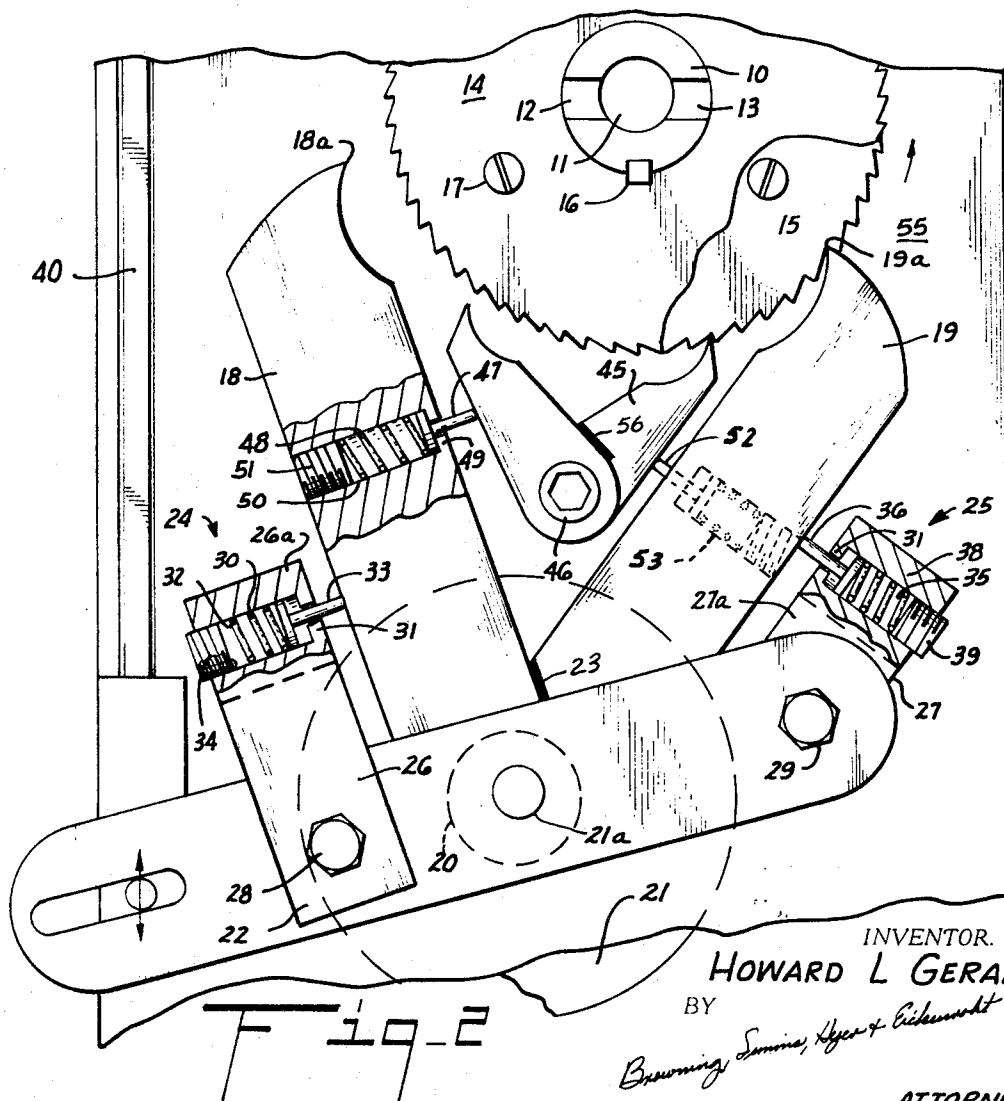
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2 Sheets-Sheet 2



F-19-3



INVENTOR.

HOWARD L GERARD

BY

BY
Browning, Leming, Hayes & Eickensmidt

ATTORNEYS

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MOTOR OPERATOR FOR LOAD BREAK SWITCH
Howard L. Gerard, Houston, Tex., assignor to Powell
Electric Manufacturing Co., Houston, Tex.
Filed Nov. 20, 1967, Ser. No. 684,252
Int. Cl. F16h 27/02

U.S. Cl. 74-143

6 Claims

ABSTRACT OF THE DISCLOSURE

This application discloses a motor operator for a load break switch that is opened and closed by rotation of an operating shaft in opposite directions. The operator includes first and second ratchet wheels, which are mounted on the operating shaft of the switch for rotation with the shaft with their ratchet teeth facing in opposite directions. First and second ratchet members are positioned to engage the first and second ratchet wheels respectively to rotate them in opposite directions. Each ratchet member has one end rotatably mounted on an eccentric to be reciprocated by rotation of the eccentric. The eccentric is driven by a motor. A shifting lever controls which of the two ratchet members are in engagement with its associated ratchet wheel at any given time, which determines the direction the operating shaft is rotated. The shifting lever is movable between a first position with the first ratchet member in engagement with the first ratchet wheel to rotate the wheel and the operating shaft of the switch in one direction, when the ratchet member is reciprocated by the eccentric, and a second position with the second ratchet member in engagement with the second ratchet wheel to rotate the wheel and the operating shaft of the switch in the opposite direction, when the second ratchet member is reciprocated by the eccentric. The shifting lever is moved between the two positions in response to movement of the switch between its open and closed positions so that the ratchet member that is in engagement with its associated ratchet wheel will be rotating the shaft to change the switch from the condition that it is in at that time, regardless of the direction of rotation of the eccentric.

This invention relates to a motor operator for a load break switch.

Most load break switches are operated by an operating shaft that is rotated in opposite directions to move the switch contacts between their opened and closed positions. Heretofore, motor operators for these switches required some means of changing the direction of output power supplied to the operating shaft. This was accomplished usually by reversing the direction of rotation of the motor, which required close control to keep the motor from continuing to supply power to the operating shaft after the position of the switch was changed.

Also, preferably, load break switches are both manually or motor operated. Motor operation allows the switch to be remotely controlled, whereas manual operation is convenient when working on the switch or testing it. Also, the ability to operate this type of switch manually is important for safety purposes should the motor operator fail for some reason. In the previously used motor operators, a clutch was used to disconnect the operating shaft from the driving motor to permit manual operation. This further complicated the operation of the operator.

It is an object of this invention to provide an improved motor operator for a load break switch that does not interfere with the manual operation of the switch thereby allowing the switch to be operated manually without having to disconnect the motor operator from the operating shaft of the switch.

It is yet another object of this invention to provide a motor operator for a load break switch that will drive the operating shaft of the switch in the direction required to change the position of the switch contacts even though the motor driving the operator continues to operate in the same direction.

It is another object of this invention to provide a motor operator for a load break switch that allows the motor driving the operator to rotate in the same direction while rotating the operating shaft of the switch in opposite directions to open and close the switch.

It is a further object of this invention to provide a motor operator for a load break switch of the type that stores energy in a spring for triggering the movement of the contacts from either the opened or the closed position that will hold whatever energy is stored in the spring by the motor when the motor is shut down without transmitting this energy back to the drive shaft of the motor.

These and other objects, advantages, and features of this invention are obtained by ratchet assemblies arranged as follows: Two ratchet wheels are mounted on the operating shaft of the load break switch with their ratchet teeth facing in opposite directions. A ratchet member is associated with each ratchet wheel for driving it in the direction opposite from the direction the other ratchet wheel is driven. A switching lever is arranged to move one or the other of the ratchet members into engagement with its associated ratchet wheel in response to the position of the contacts of the switch. Thus, when the switch is open, the switching lever will be in position to hold the ratchet member in engagement with the ratchet wheel that will rotate the operating shaft in the direction required to close the switch. Conversely, when the switch is closed, the switching lever moves the other ratchet member into engagement with its associated ratchet wheel to drive the operating shafts in the opposite direction to open the switch. The ratchet members can be reciprocated in any convenient manner. In the preferred embodiment, they are reciprocated by an eccentric driven from the output shaft of a motor. This allows the motor operator to operate the switch and rotate the operating shaft in different directions although the output shaft of the motor rotates in the same direction at all times. Further, the switch can be operated manually at any time and the ratchet member in engagement with its associated ratchet wheel at that time will simply ratchet and not interfere in any way with further rotation of the ratchet wheel.

The invention will now be described in detail in connection with the attached drawings in which,

FIGURE 1 is a front view of the preferred embodiment of the motor operator in position to rotate the operating shaft of a load break switch in a clockwise direction;

FIGURE 2 is a view similar to FIGURE 1 with the operator in position to drive the operating shaft of the switch in the opposite direction from that in which it is driving it in FIGURE 1; and

FIGURE 3 is a perspective view of a portion of the operating mechanism of a load break switch.

It is very important that load break switches be opened and closed rapidly. This is done usually by storing energy, such as spring energy, and then releasing this energy rapidly to open or close the switch contacts. FIGURE 3 illustrates the arrangement used on General Electric load break switch, model SE-100, one of such switches upon which the motor operator of this invention has been used.

Operating shaft 10 is arranged to rotate shaft 9 (FIGURE 3) upon which is mounted two arms, only one of which, arm 8, is shown. As arm 8 is rotated with shaft 9, it moves away from stop 5 and compresses spring 7 until the arm passes a position in line with the longitudinal axis of the spring. Movement of arm 8 past this position releases the energy stored in spring 7, and a similar spring

7a compressed by the other arm mounted on the shaft, which quickly rotates arm 8 and shaft 9 to a position against stop 6, 180° from its previous position. A lost motion connection between shaft 9 and the switch contacts allow arm 8 to be moved to its in-line position with spring 7 without moving the movable contacts of the switch. As the springs take over, however, shaft 9 will move the contacts into or out of engagement with the stationary contacts of the switch depending on the direction of movement of shaft 9.

Thus, rotation of operating shaft 10 in one direction opens the contacts of the switch. Rotation in the other direction closes them. It is not important for our purposes here which direction does what. For manual operation of the switch, operating shaft 10 is provided with central opening 11 and laterally extending slots 12 and 13 to receive a crank of conventional design.

The motor operator of this invention includes first ratchet wheel 14 and second ratchet wheel 15. These ratchet wheels are mounted side by side on operating shaft 10 and held against rotation relative to the shaft by key 16. The two wheels are connected together by machine screws 17.

The ratchet wheels are mounted on shaft 10 with their ratchet teeth facing in opposite directions. The teeth on first ratchet wheel 14 are arranged to rotate the shaft in a clockwise direction, whereas the teeth on second ratchet wheel 15 are facing in the direction to rotate the shaft in a counterclockwise direction. To rotate the ratchet wheels, first ratchet member 18 and second ratchet member 19 are provided for engaging the first and second ratchet wheels, respectively. In the embodiment shown, the ratchet members are elongated members of rectangular cross-section. The ends of the members that engage the ratchet wheels are shaped, as shown, to provide pointed edges 18a and 19a to engage the teeth on the periphery of the wheels.

Means are provided for reciprocating the ratchet members to cause each member to move the ratchet wheel it engages. In the embodiment shown, each ratchet member has one end rotatably mounted on eccentric 20. The eccentric comprises a cylindrical member mounted on output shaft 21a of electric motor 21 with its longitudinal axis parallel to but offset from the axis of shaft 21a. Thus, this will cause eccentric 20 to reciprocate ratchet members 18 and 19 as it is rotated by shaft 21a.

Means are provided, which are responsive to the position of the switch, to move one of the first and second ratchet members into engagement with its associated ratchet wheel and for moving the other ratchet member out of engagement with its associated ratchet wheel to cause the operating shaft of the switch to be rotated in the direction required to change the position of the switch, when the ratchet members are reciprocated. Ratchet members 18 and 19 extend upwardly from eccentric 20 on opposite sides of ratchet wheels 14 and 15 and are connected together, as by weld 23, to fix the angle between them.

Shifting lever 22 is rotatably mounted on output shaft 21a of electric motor 20. Carried by shifting lever 22 and located on opposite sides of the ratchet members are first and second resilient stop assemblies 24 and 25.

Stop assemblies 24 and 25 include rectangular blocks 26a and 27a, which are attached to positioning arms 26 and 27 (FIGURE 4). The positioning arms are fixed to shifting lever 22 by bolts 28 and 29, which can be loosened to allow the position of blocks 26a and 27a to be adjusted. Block 26 has concentric openings 30 and 31 of different diameters. Spring 32 is located in opening 30 and exerts a resilient force on pin 33, which extends through opening 31 to engage the side of ratchet member 18. The end portion of pin 33 located in opening 30 is enlarged to about the diameter of the opening for engagement by spring 32. Set screw 34 allows the force exerted by spring 32 on pin 33 to be adjusted. In the

same manner, spring 32, set screw 35, and pin 36 are arranged in openings 37 and 38 in block 27a so pin 36 will engage the side of ratchet member 19.

The first and second resilient stop assemblies 24 and 25, respectively, are positioned on shifting lever 22 so that when the lever is in the position shown in FIGURE 1, first stop assembly 25 will resiliently hold first ratchet member 18 in position to engage the teeth on first ratchet wheel 14 to move the operating shaft 10 in a clockwise direction as the ratchet member is reciprocated by eccentric 20. Moving ratchet arm 18 into engagement with its ratchet wheel will move ratchet arm 19 out of engagement with ratchet wheel 15, since the angle between them is fixed.

By moving shifting lever 22 to the position shown in FIGURE 2, its second position, the second stop assembly 25 will move up so that pin 36 moves ratchet member 19 into engagement with ratchet wheel 15. Then as ratchet member 19 is reciprocated, ratchet wheel 15 will rotate the operating shaft of the switch in a counterclockwise direction. As the shifting lever is moved to its second position, first stop assembly 24 will move far enough to the left, as viewed in FIGURES 1 and 2 to permit ratchet member 18 to be moved out of engagement with the first ratchet wheel 14 by the movement of member 19.

Shifting lever 22 is moved between its first and second positions by actuating arm 40 and link 41, which is connected to the actuating arm by pin 42. Link 41 moves only when the switch contacts move. Thus, when the switch moves to the open position, link 41 will cause the shifting lever to be moved quickly from its first to its second position by the same spring energy used to move the switch contacts. This can be accomplished in various ways, as, for example, by arranging link 41 to be moved by shaft 9 (FIGURE 3) through a lost motion connection. Therefore, there will be no gradual movement of shifting lever 22 from one position to the other as the operating shaft is rotated, but link 41 will operate only as the spring energy is released which, at that time, will place the switch in position for the operating shaft to be rotated in the opposite direction. Therefore, the ratchet members will be in position to continuously rotate operating shaft 10 in the proper direction, i.e., in the direction to change the condition of the switch, even though the motor driving the operator runs continuously in the same direction.

Pawls 44 and 45 are rotatably mounted on pin 46 and located below the ratchet wheels and between the ratchet members. Pin 46 is supported by plate 55. Like ratchet members 18 and 19, pawls 44 and 45 are connected together, as by weld 56, to fix the angle between them. The pawls are arranged to hold the ratchet wheels from rotating in a direction opposite that from which they are being rotated by the actuating members. This is necessary to allow energy to be stored in the actuating springs of the switch. For example, if first ratchet member 18 is rotating first ratchet wheel 14 and building up energy in switch spring 7 to operate the switch, if ratchet wheel 14 were not held against rotation in a counterclockwise direction each time ratchet member 18 moves back to engage another tooth, the spring would simply force the ratchet wheel to move in a counterclockwise direction and the wheel would simply set there and oscillate with the reciprocation of ratchet member 18. Therefore, as ratchet member 18 moves into engagement with ratchet wheel 14, as shown in FIGURE 1, spring loaded pin 47 engages first pawl 44 and moves it into position to engage the teeth on ratchet wheel 14. Pin 47 is resiliently held in engagement with pawl 44 by spring 48. The pin extends through opening 49 of relatively small diameter, whereas spring 48 is located in bore 50 of increased diameter. Set screw 51 allows the spring force on pin 47 to be adjusted.

In the same manner, pin 52 engages second pawl 45 and

moves it into position to engage the teeth on second ratchet wheel 15, when shifting lever 22 is moved to the position shown in FIGURE 2. Pin 52 is resiliently held in engagement with pawl 45 by springs 53. The angle between the pawls is such that the movement of one pawl into engagement with a ratchet wheel will move the other out of engagement with its associated ratchet wheel.

Pins 33, 36, 47, and 52 are held in engagement with the various members of the operator by springs so that the pawls and ratchet members can move outwardly far enough to ride over the teeth on the ratchet wheels, as this is required in the operation of the mechanism.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the apparatus and structure.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. A motor operator for a load break switch that is opened and closed by rotation of an operating shaft in opposite directions, comprising first and second toothed ratchet wheels mounted on the operating shaft of the switch for rotating with the shaft with the teeth on the wheels facing in opposite directions; first and second ratchet members, means mounting the first ratchet member for movement into and out of driving engagement with the first ratchet wheel to move the ratchet wheel in one direction, when the first ratchet member is reciprocated, means mounting the second ratchet member for movement into and out of driving engagement with the second ratchet wheel for moving the second ratchet wheel in a direction opposite to the direction the first wheel is driven, when the second ratchet member is reciprocated, means responsive to the position of the switch for moving one of the first and second ratchet members into engagement with its associated ratchet wheel and for moving the other ratchet member out of engagement with its associated ratchet wheel to cause the shaft to be rotated in the direction required to change the position of the switch when the ratchet members are reciprocated, and means for reciprocating the ratchet members.

2. The motor operator of claim 1 in which the means for reciprocating the ratchet members includes an eccentric upon which both ratchet members are rotatably mounted and means for rotating the eccentric to cause the members to reciprocate.

3. The motor operator of claim 2 in which the eccentric and the ratchet members are positioned with the ratchet members extending from the eccentric on opposite sides of the ratchet wheels.

4. The motor operator of claim 3 in which the means for moving one of the ratchet members into, and the other out of, engagement with the ratchet wheels, respectively, includes a shifting lever rotatably mounted intermediate its ends on the eccentric; first and second resilient stop assemblies carried by and fixed relative to the lever and located on opposite sides of the ratchet members to engage the first and second ratchet members, respectively, and means for rotating the shifting lever between a first position with the first stop assembly holding the first ratchet member in engagement with the first ratchet wheel to rotate the wheel and the operating shaft of the switch in one direction when the ratchet member is reciprocated by the eccentric and a second position with the second stop assembly holding the second ratchet member in engagement with the second ratchet wheel to rotate the wheel and the operating shaft of the switch in the opposite direction when the second ratchet member is reciprocated by the eccentric.

5. The motor operator of claim 4 further provided with first and second pawls for alternately engaging the first and second ratchet wheels, respectively, to hold the ratchet wheels from rotating in a direction opposite from the direction each is rotated by its ratchet member.

6. The motor operator of claim 5 in which the pawls are pivotally mounted between the ratchet members and the ratchet wheels and in which the first and second ratchet members carry first and second resilient pawl actuating assemblies for engaging the first and second pawls, respectively, to hold the first pawl in position to hold the first ratchet wheel from rotating in a direction opposite the direction the first ratchet wheel is rotated by the first ratchet member when it is held in engagement with the first wheel by the first stop assembly and reciprocated and to hold the second pawl in position to hold the second ratchet wheel from rotating in a direction opposite the direction the second ratchet wheel is rotated by the second ratchet member when it is held in engagement with the second wheel by the second stop assembly and reciprocated.

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FRED C. MATTERN, JR., Primary Examiner

W. S. RATLIFF, JR., Assistant Examiner